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Lin

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(54) **CIRCULATING TYPE MILLING APPARATUS FOR MILLING A LOCK CORE KEYWAY**

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(51) **Int. Cl.**[7] **B23Q 7/02**; B23D 37/10

(52) **U.S. Cl.** **29/563**; 29/564; 409/251; 409/259

(58) **Field of Search** 29/563, 564; 409/250, 409/251, 259, 269, 270, 271, 272, 273, 274, 275

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,343,420	*	3/1944	Podesta	409/250
2,893,293	*	7/1959	Poynter	409/273
3,799,030	*	3/1974	Schubert	409/259 X
4,432,130	*	2/1984	Gabriele	29/563
5,326,201	*	7/1994	King	29/563 X

FOREIGN PATENT DOCUMENTS

37696		6/1981	(TW) .
44973		7/1982	(TW) .
300181	*	3/1997	(TW) ..... 29/563 X

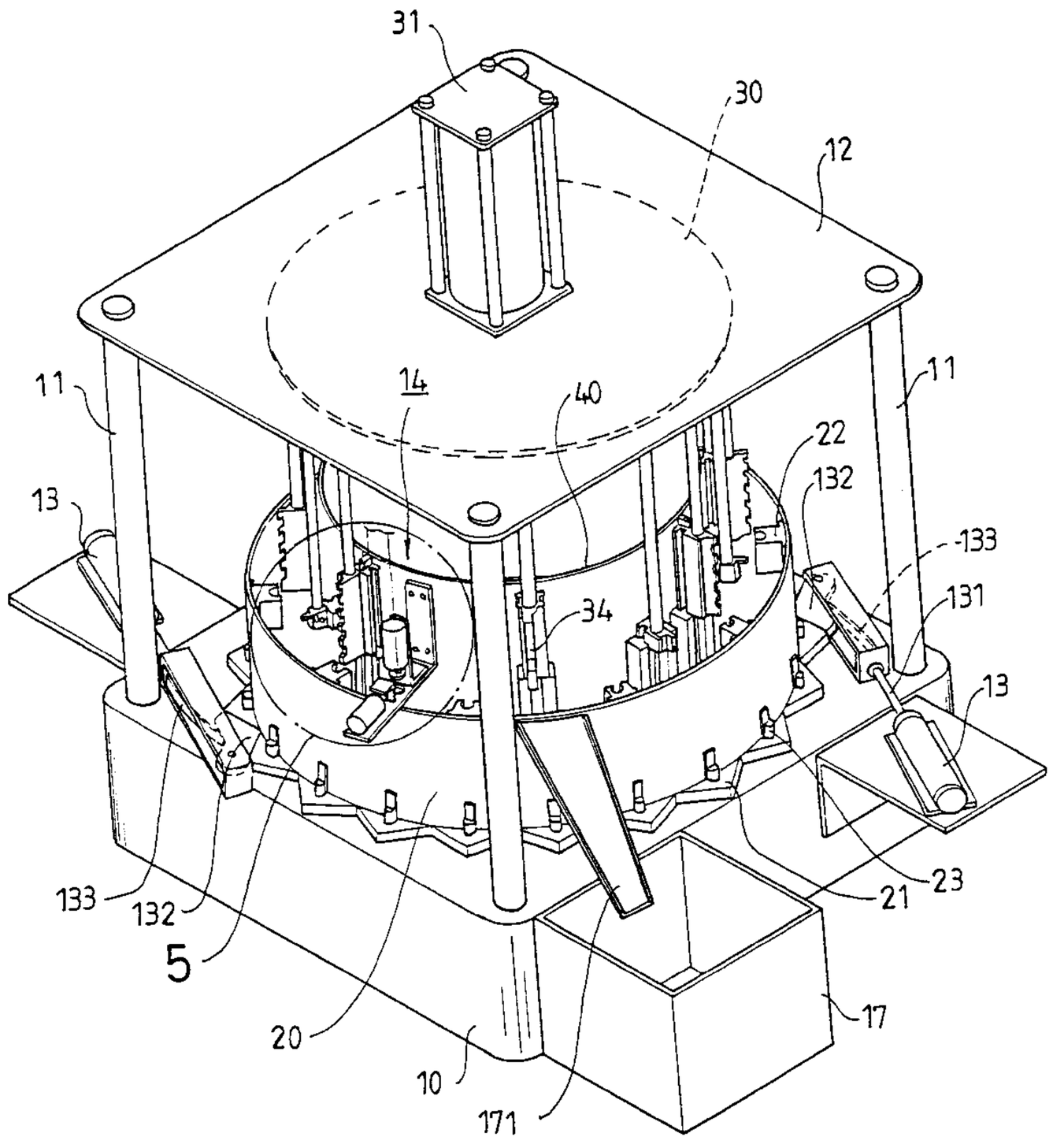
* cited by examiner

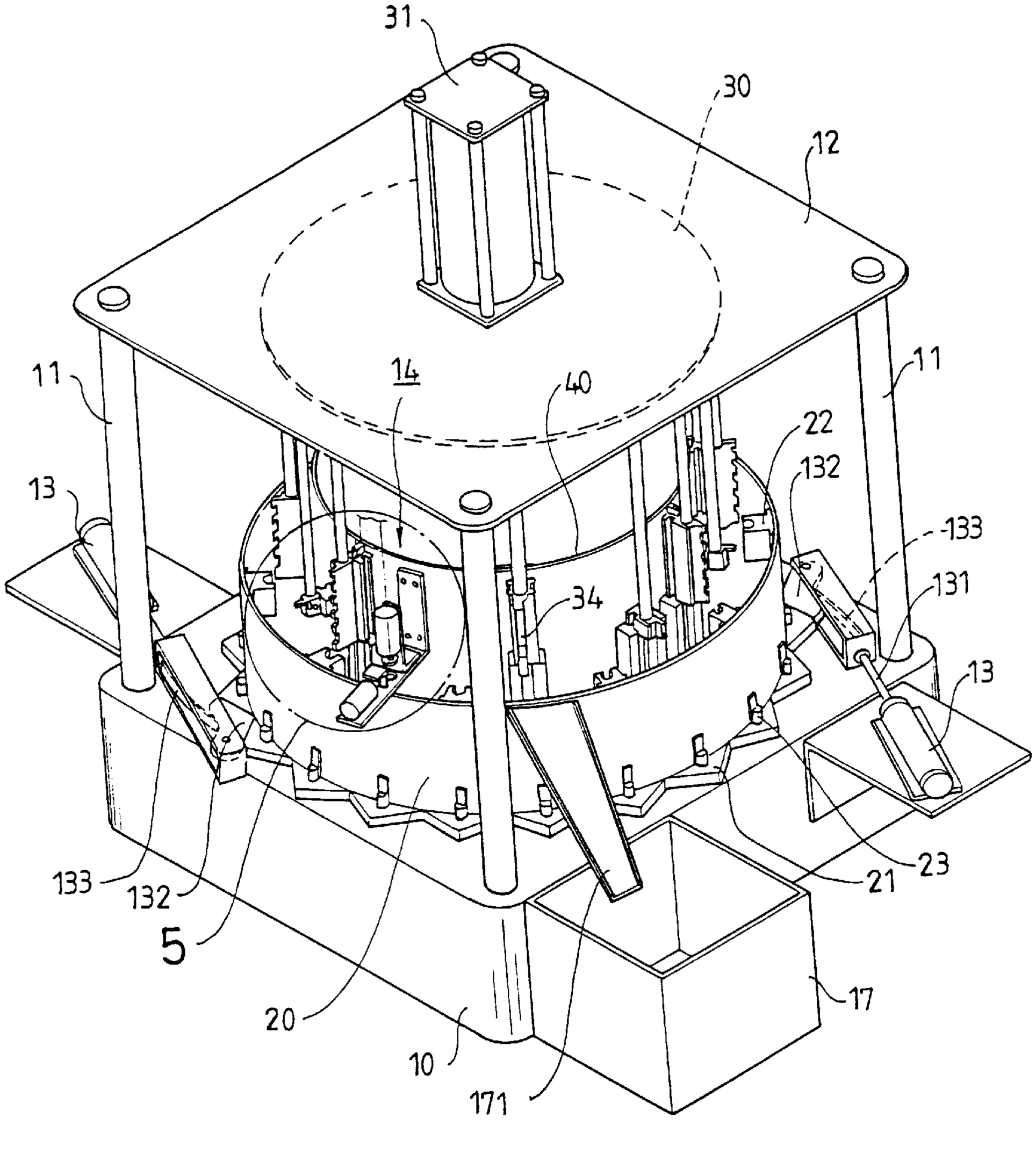
Primary Examiner—William Briggs

(57) **ABSTRACT**

A circulating type milling apparatus for milling a lock core keyway includes a frame with a rotating disc that is intermittently rotated through a pre-determined angle. Lock core seats are equidistantly provided on the rotating disc. A milling disc is mounted to a top plate of the frame and includes cutters, ejecting plate, and detectors mounted thereon. The cutters are lowered to mill a keyway in each lock core. When the cutters are further moved downward and thus disengaged from the lock cores, the rotating disc is rotated by a distance that is equal to a half distance between two adjacent lock core seats such that each lock core seat is in a positioning in alignment with an associated detector yet not in alignment with an associated cutter. When the milling disc is moved upward, the detector checks whether the milled keyway of the lock core meets the required standard. The ejecting plate ejects the finished milled lock core, and a new lock core is fed by a lock core supplying device.

8 Claims, 9 Drawing Sheets

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171

FIG .1

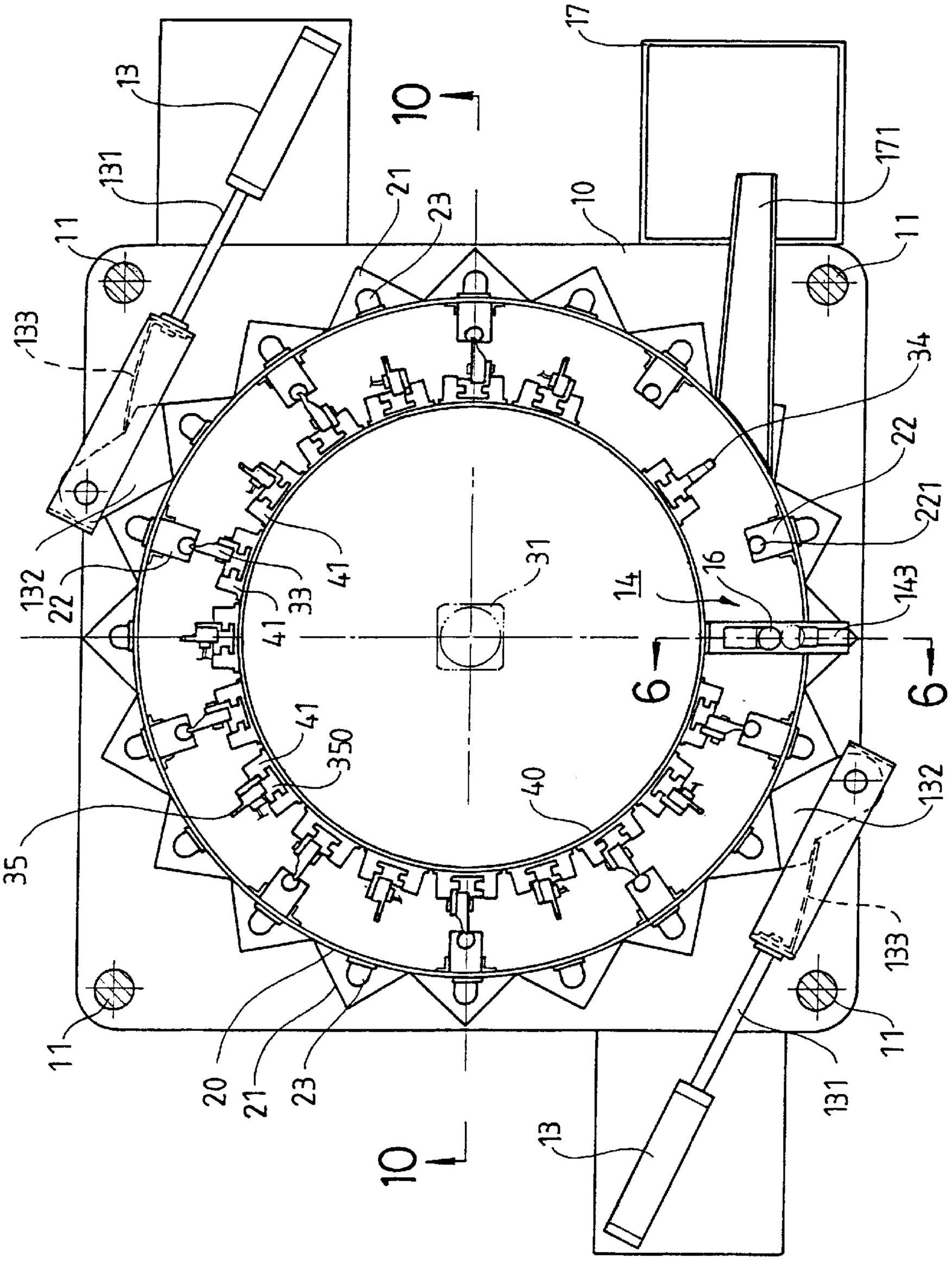
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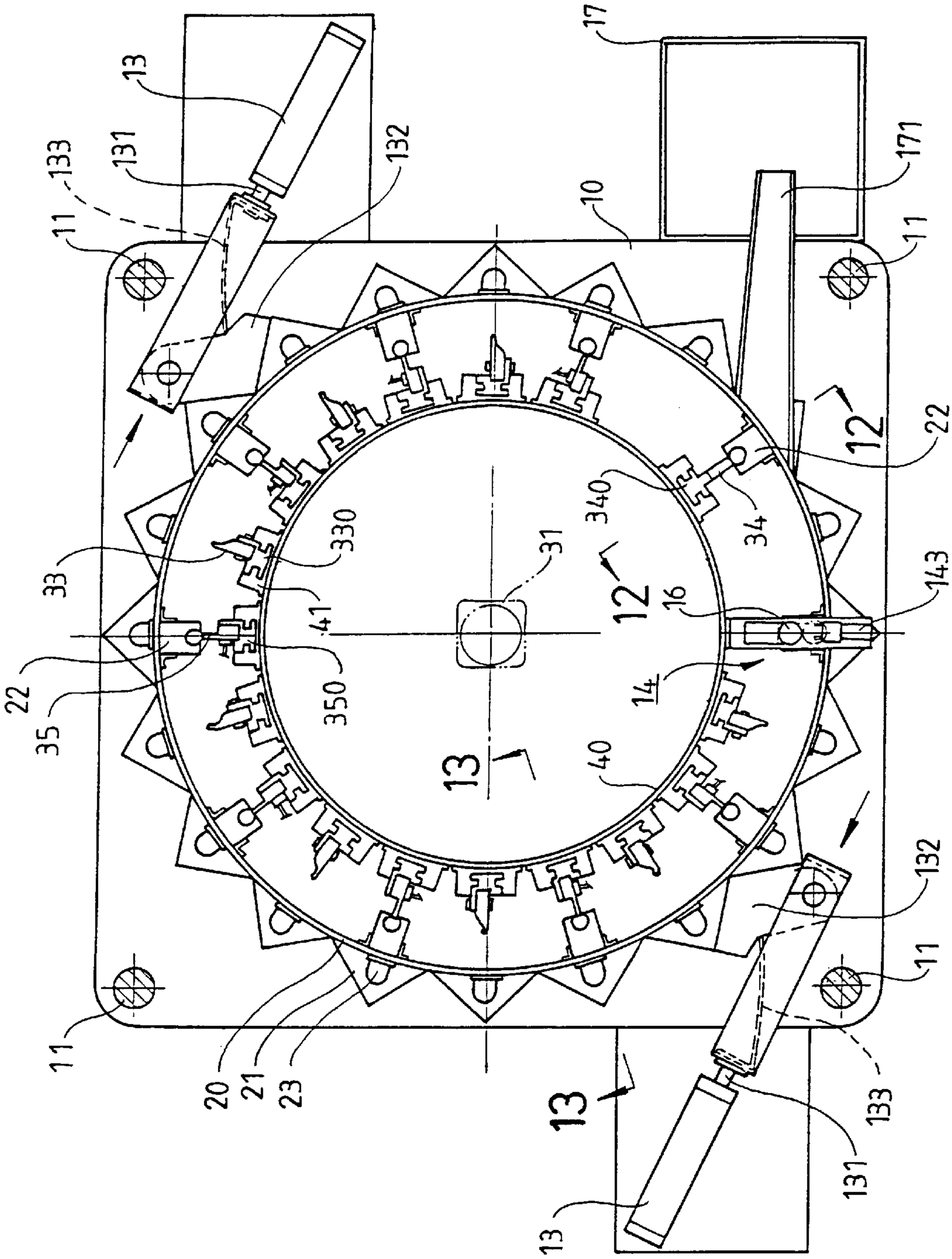
FIG. 2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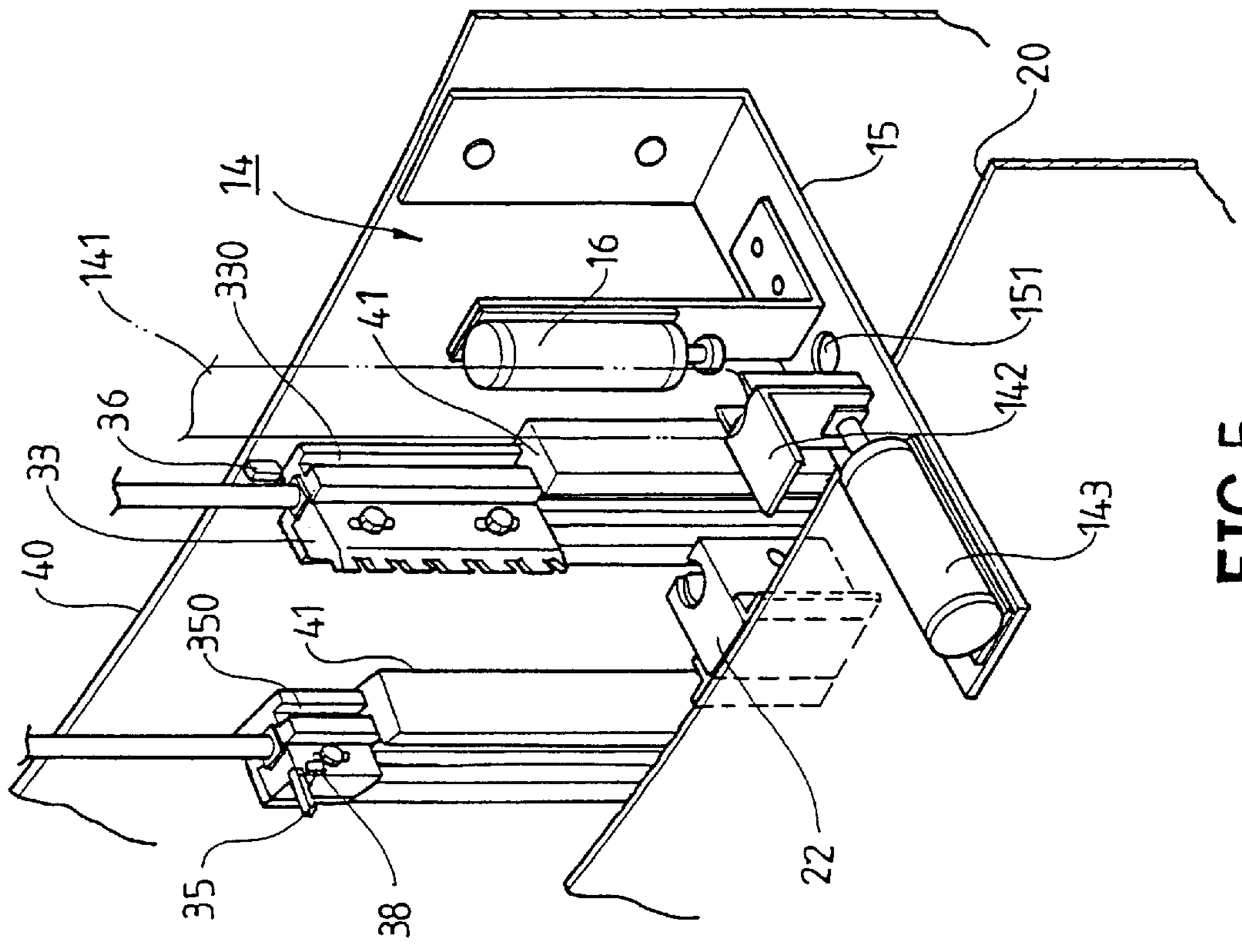
21
23
1

FIG. 3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15
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141
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151
36
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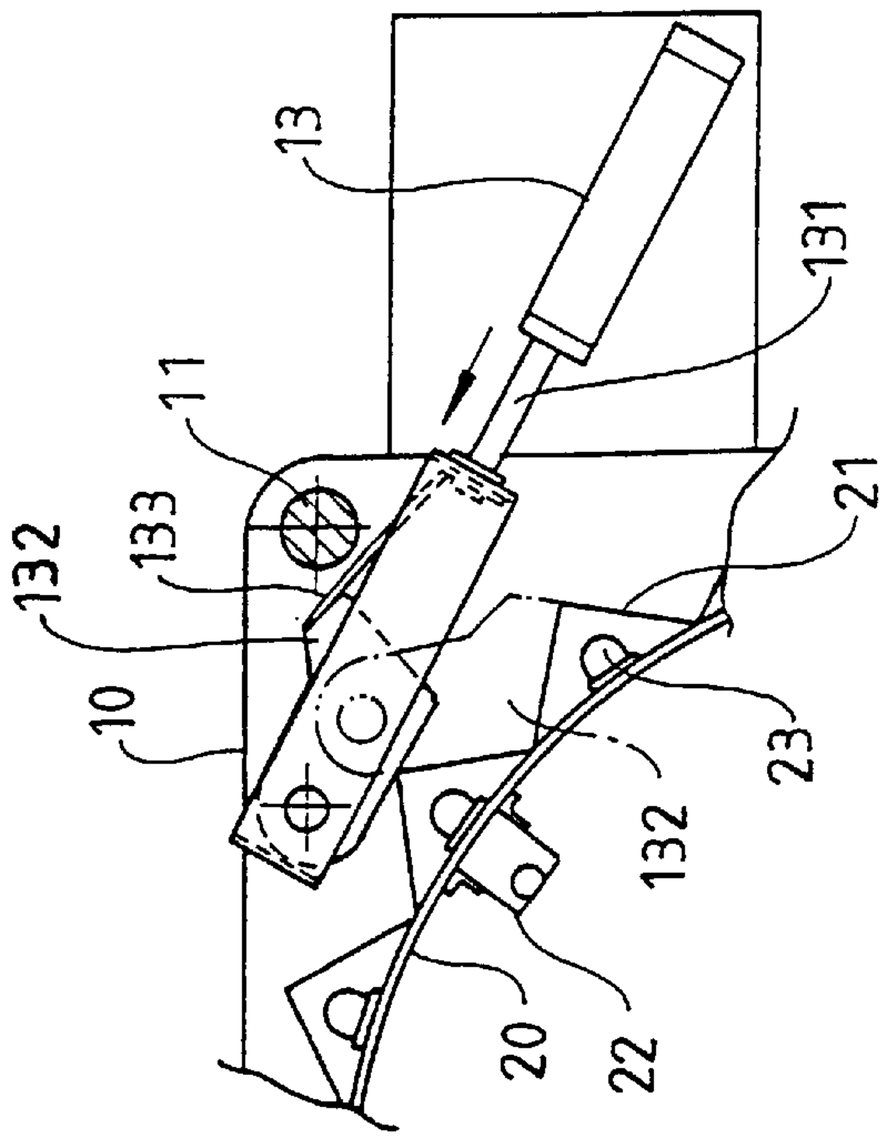
38
22

FIG.5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22

FIG.4

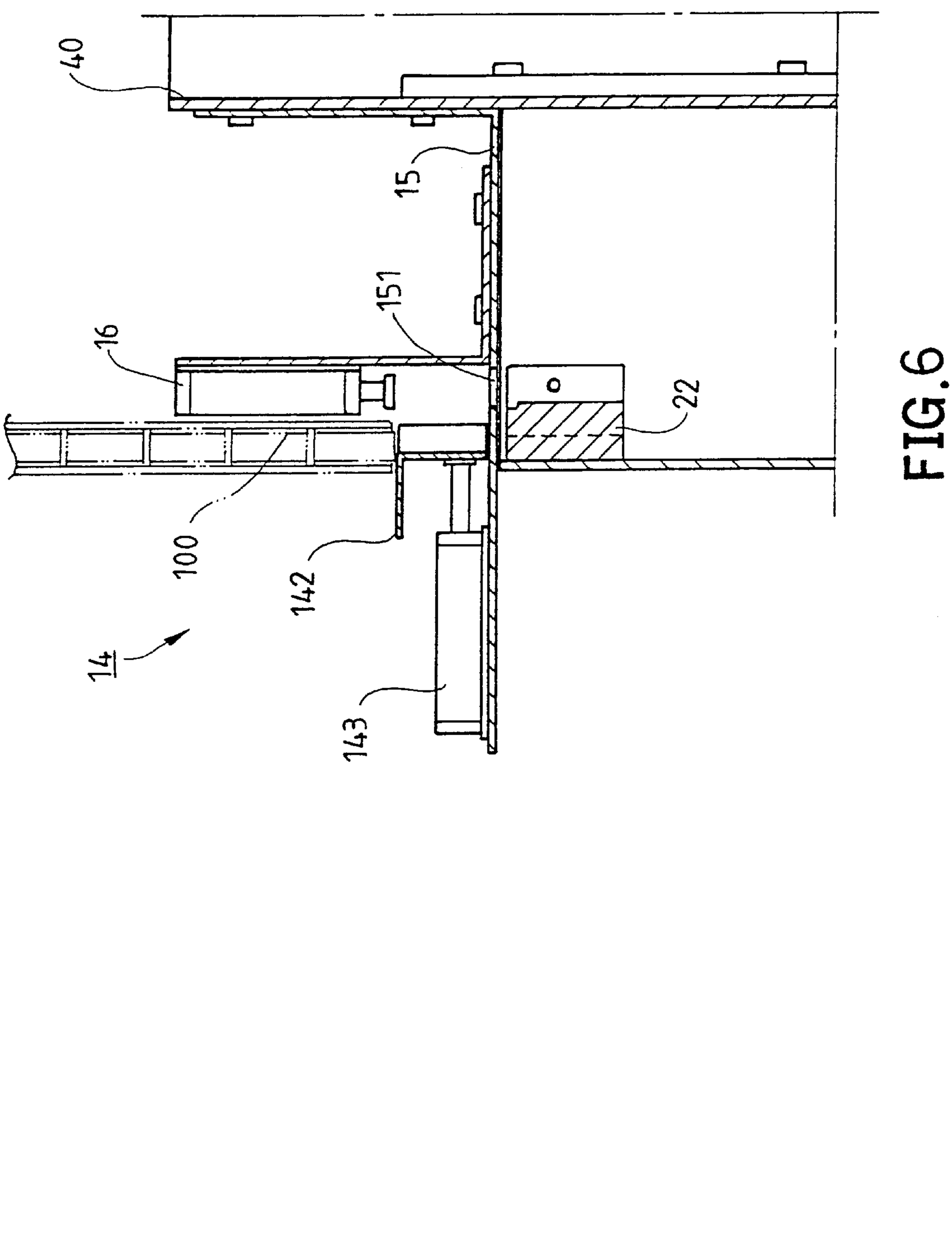
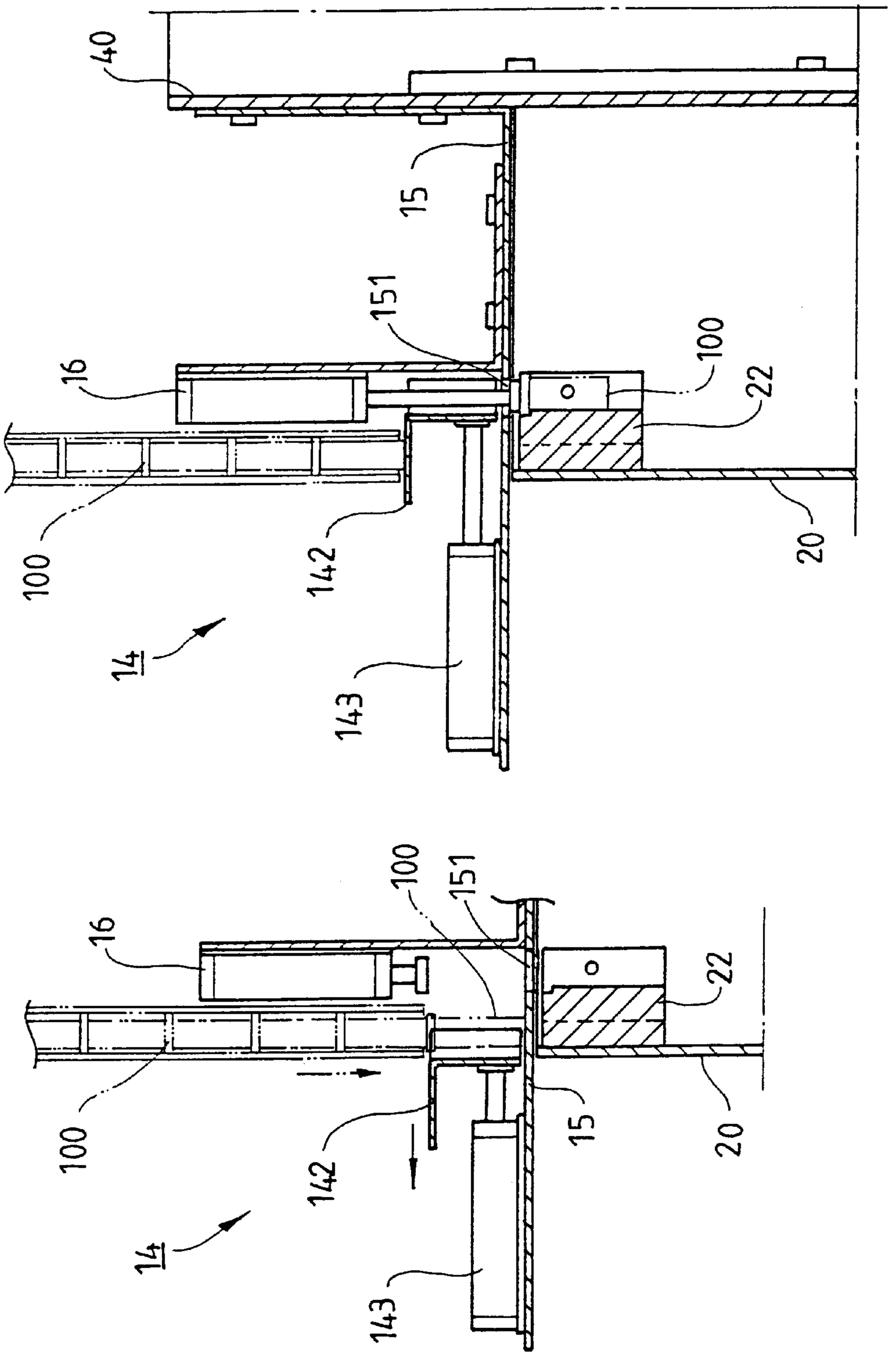


FIG.6


40
15
151
16
100
22
100
142
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14
143

FIG.8

100
151
16
22
100
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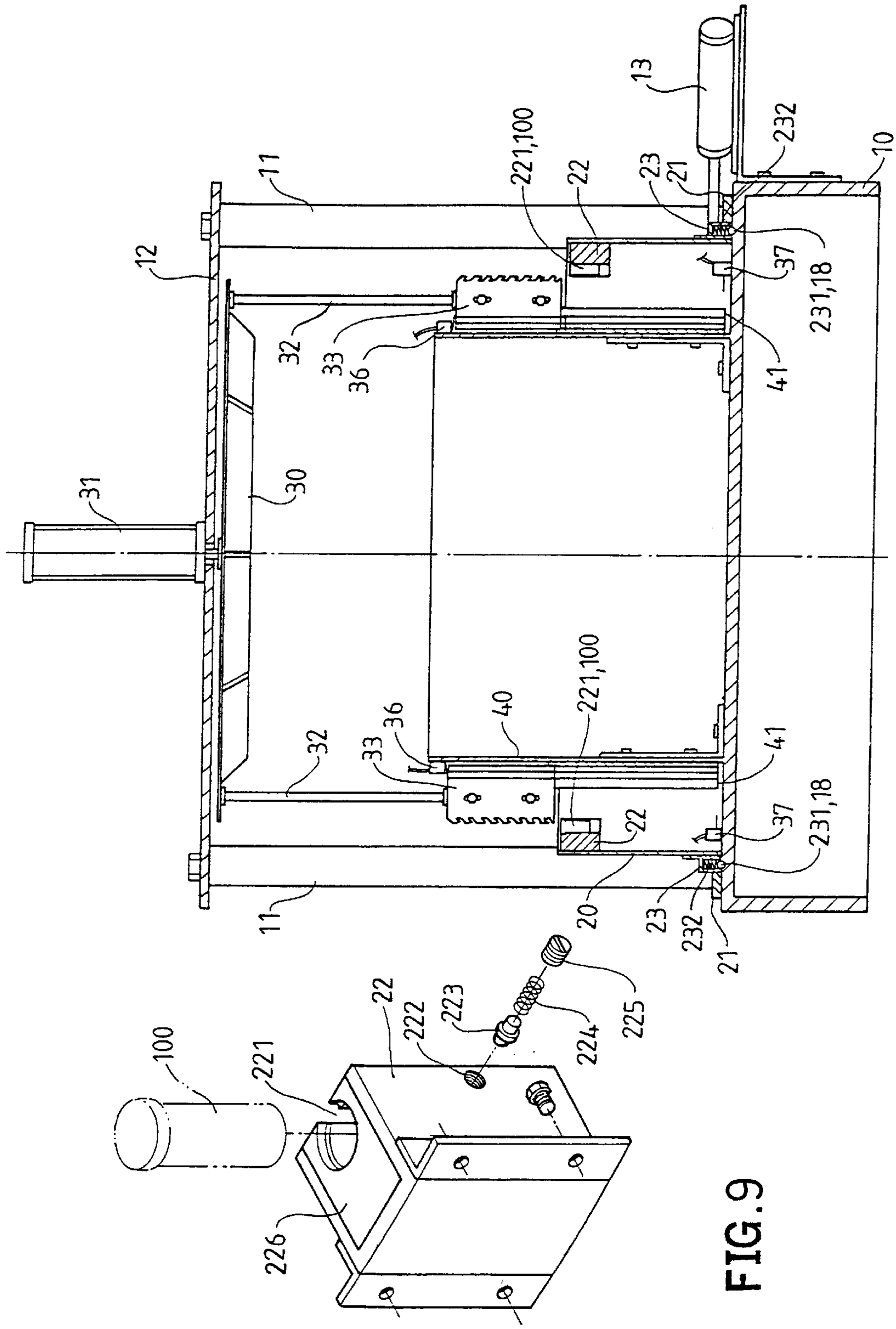
142
20
14
143

FIG.7


13
221,100
22
23
21
232
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11
12
32
33
36
37
231,18
41
31
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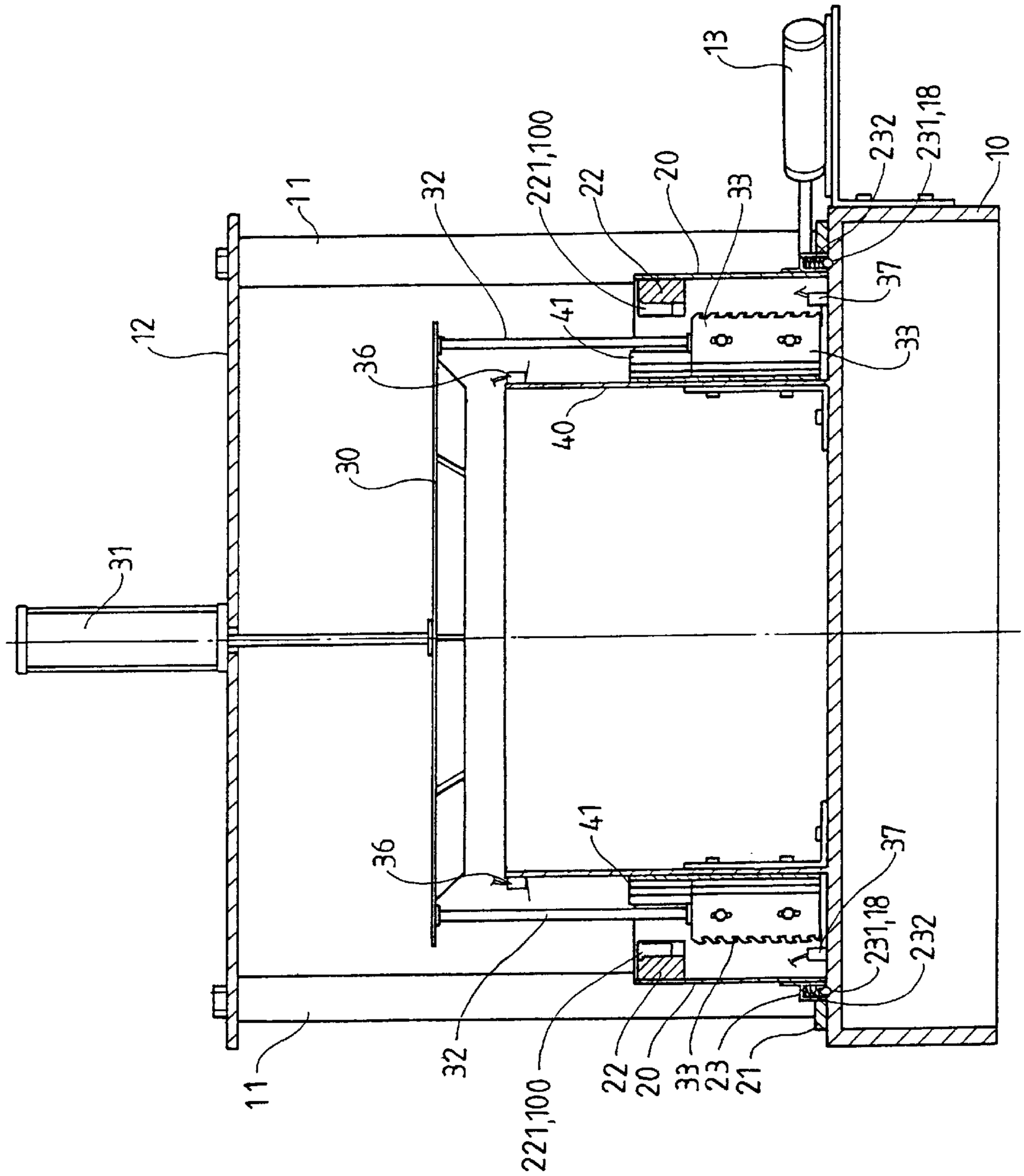
40
20

FIG.10

10
221
100
22
222
223
224
225
226

FIG.9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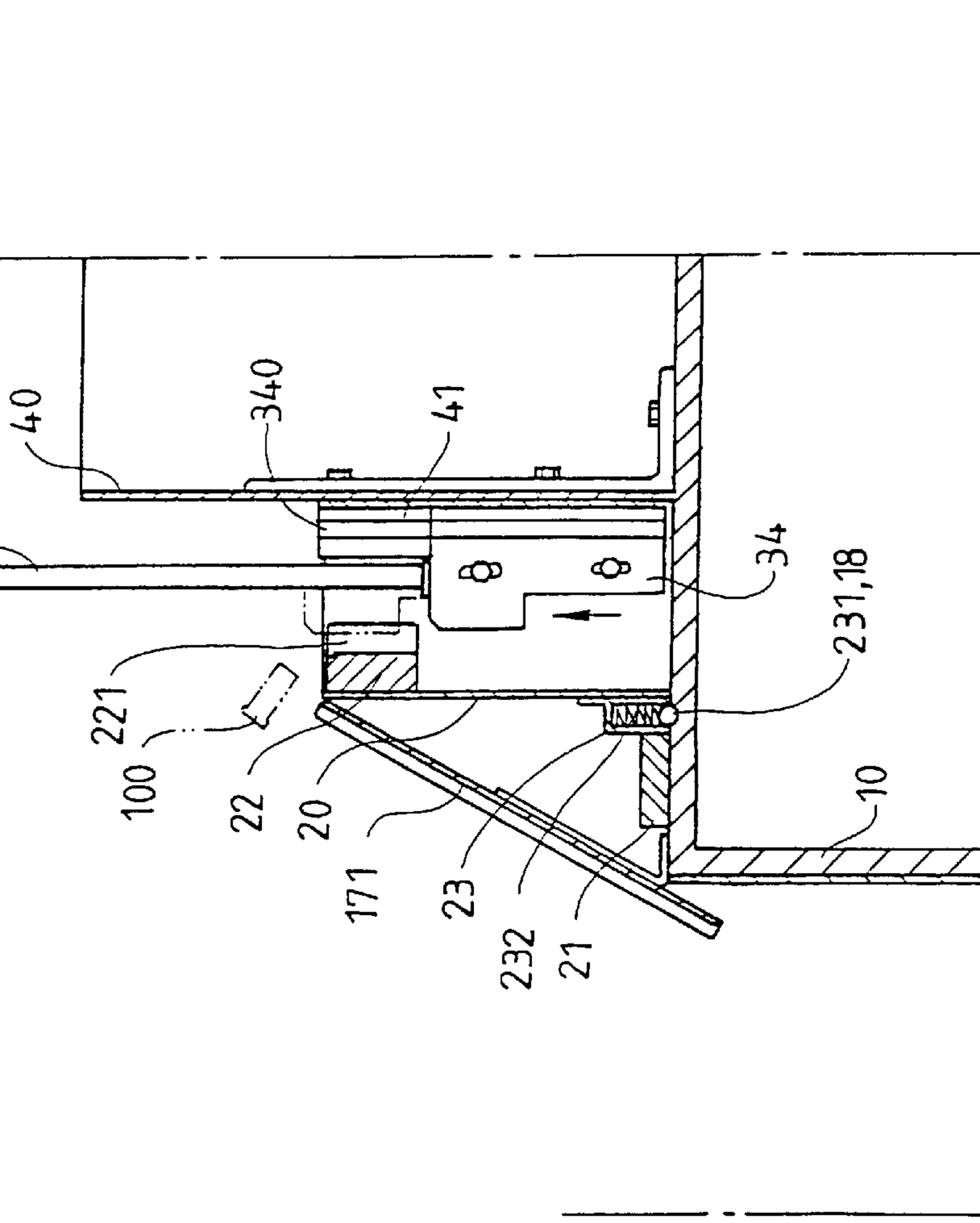
231,18
232

FIG.11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340
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34
231,18
221
100
22
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171
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FIG.13

FIG.12

CIRCULATING TYPE MILLING APPARATUS FOR MILLING A LOCK CORE KEYWAY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a circulating type milling apparatus for milling the keyway of a lock core at high speed.

2. Description of the Related Art

Taiwan Utility Model Publication No. 37696, entitled "AUTOMATIC MILLING DEVICE FOR LOCK CORES" and issued on Jun. 1, 1981, discloses a reciprocating cutter mounted on a movable base, a key being provided on the base for activating a control rod and a control arm for automatically urging a lock core to fall into a milling seat and thus be milled to form a keyway.

Taiwan Utility Model Publication No. 44973, entitled "MILLING DEVICE FOR LOCK CORES" and issued on Jul. 1, 1982, discloses a base with a cutter seat to which a cutter is mounted, and a motor is provided for driving a chain wheel. A milling seat frame and a milling seat are carried by a chain and thus conveyed along the conveying direction such that a lock core in the milling seat is milled by the cutter on the base to form a keyway.

It is, however, found that the milling speeds of the milling devices discloses in the above two disclosures are relatively low, only 3–4 lock cores are milled per minute. In addition, the whole cutter must be replaced if a small portion of the cutter is damaged, which is not economical.

Taiwan Utility Model Publication No. 300181, entitled "REVOLVER TYPE MILLING DEVICE FOR LOCK CORES" and issued on Mar. 11, 1997, discloses a frame with a revolver disc rotatably supported by a bearing and having posts for a working table that is moved vertically by a cylinder means. The revolver disc is attached to a shaft that is rotatably held by the bearing. A bevel gear is intermittently driven to cause the revolver disc to travel through a certain angle at regular time. A number of seats are mounted on the revolver disc for holding lock cores. When the working table is moved by the cylinder means, cutters on the working table mill the lock cores on the revolver disc in response to reciprocating movements of the posts of the frame, and the milling procedure on each lock core is continued when the revolver disc is rotated to next angular position to finally form a keyway on each lock core. It is, however, found that a tooth space difference exists when the lock core is turned, as the bevel gear is intermittently driven. Accordingly, the keyway formed by milling has a larger tolerance, resulting in lock cores with unreliable quality.

The present invention is intended to provide a circulating type milling apparatus for milling a lock core keyway that mitigates and/or obviates the above problems.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a circulating type milling apparatus for precisely and rapidly milling a lock core keyway for each lock core.

A circulating type milling apparatus for milling a lock core keyway in accordance with the present invention comprises a frame with a rotating disc that is rotated through a predetermined angle. Lock core seats are provided on the rotating disc. Lock cores are filled into the lock core seats one by one and then milled by cutters that are mounted to a vertically movable milling disc, which, in turn, is actuated by, e.g., a hydraulic cylinder. The cutters are guided downward by tracks arranged on an annular fixed wall for simultaneously milling the lock cores. When a lower sensor detects that the cutters are moved downward and thus disengaged from the lock cores, the rotating disc is rotated by a distance that is equal to a half distance between two adjacent lock core seats such that each lock core seat is in a positioning in alignment with a detector. When the milling disc is moved upward, the detector checks whether the milled keyway of the lock core meets the required standard. If a cutter fails to mill the keyway to the required standard as a result of wear, the detector sends a signal to stop the whole milling apparatus for replacing the cutter. When an upper sensor detects that the milling disc is moved upward to a preset position, the detector disengages from the lock core seat, and the rotating disc is rotated again by a distance that is equal to a half distance between two adjacent lock core seats for next milling. Milling of the lock core is finished when the rotating disc is rotated through 360°, and the milled lock core is ejected by an ejecting plate.

Other objects, advantages, and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a circulating type milling apparatus in accordance with the present invention,

FIG. **2** is a top plan view of a circulating type milling apparatus in accordance with the present invention, wherein the top plate is removed for clarity;

FIG. **3** is a view similar to FIG. **2**, wherein the rotating disc is rotated through a tooth pitch;

FIG. **4** is a top view illustrating operation between a ratchet tooth and the tooth of the rotating disc;

FIG. **5** is an enlarged perspective view of a circle in FIG. **1**;

FIG. **6** is a sectional view taken along line **6—6** in FIG. **2**;

FIG. **7** is a sectional view similar to FIG. **6**, wherein the stop plate is moved to a position allowing next lock core to fall onto the support plate,

FIG. **8** is a sectional view similar to FIG. **7**, wherein the lock core is pushed to a position above a hole in the support plate;

FIG. **9** is a perspective view, partly exploded, of the lock core seat;

FIG. **10** is a sectional view taken along line **10—10** in FIG. **2**;

FIG. **11** is a sectional view similar to FIG. **10**, wherein the cutters are moved to the bottommost position;

FIG. **12** is a sectional view taken along line **12—12** in FIG. **3**; and

FIG. **13** is a sectional view taken along line **13—13** in FIG. **3**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. **1** and **2**, a circulating type milling apparatus in accordance with the present invention generally includes a frame **10**, a rotating disc **20**, a milling disc **30**, and an annular fixed wall **40**. The frame **10** includes a plurality of posts **11** for supporting a top plate **12**. At least one cylinder (two hydraulic cylinders **13** in this embodiment) is provided to cause the rotating disc **20** to rotate. Each

cylinder **13** includes an actuating rod **131** with a ratchet tooth member **132** pivotally connected to a distal end thereof. The rotating disc **20** includes a plurality of teeth **21** formed on an outer periphery thereof for releasably meshing with the ratchet tooth member **132**. When the actuating rod **131** of the cylinder **13** retracts from an extended position shown in FIG. **2** to a retracted position shown in FIG. **3**, the rotating disc **20** is rotated, e.g., clockwise through a tooth pitch by the ratchet tooth member **132**. When the actuating rod **131** of the cylinder **13** extends from the retracted position in FIG. **3**, the ratchet tooth member **132** slides over the tip of an associated tooth **21** (see FIG. **4**) and then engages with next two adjacent teeth **21** of the rotating disc **20**. As illustrated in FIG. **4**, during sliding movement, the ratchet tooth member **132** is pivoted by the associated tooth **21** and bears against a resilient plate **132** that biases the ratchet tooth member **132** to engage with the teeth **21** of the rotating disc **20**.

Referring to FIGS. **5** and **6**, the frame **10** includes a lock core supplying means **14** that utilizes a guide tube **141** for allowing lock cores **100** to fall onto a support plate **15** one by one. A stop plate **142** is provided under the guide tube **141** and actuated by a cylinder **143**. When the stop plate **142** is below the guide tube **141**, falling (i.e., feeding) of the lock cores **100** is stopped, as shown in FIG. **6**. When the stop plate **142** is moved away from the guide tube **141**, a lock core **100** falls onto the support plate **15**, best shown in FIG. **7**. Next, the stop plate **142** is actuated again by the cylinder **143** to a place below the guide tube **142**, thereby stopping falling of next lock core **100** and pushing the lock core **100** to a hole **151** in the support plate **15**. As a result, the lock core **100** falls into an associated lock core seat **20** via the hole **151** under actuation of a cylinder **16** above the hole **151**. Next retracting stroke of the cylinder **143** causes the next lock core **100** to fall onto the support plate **15**.

Referring to FIGS. **1** and **2** again, the frame **10** further includes a guide plate **171** for guiding a milled lock core into a collecting box **17**.

The teeth **21** on the rotating disc **20** are equidistantly arranged. When a respective tooth **21** is pushed by the ratchet tooth member **132**, the rotating disc **20** is rotated through a distance equal to a half distance between two adjacent lock core seats **22**. In order to provide a better positioning effect after rotation of the rotating disc **20**, a plurality of positioning members **23** are provided to the periphery of the rotating disc **20**. As illustrated in FIG. **10**, each positioning member **23** includes a steel ball **231** and an elastic element **232**. In addition, the frame **10** includes a plurality of annularly, equidistantly arranged arcuate depressions **18**. Each steel ball **231** is biased by the associated elastic element **232** to be releasably retained in an associated depression **18**. Thus, the rotating disc **20** may be precisely positioned after every rotation.

Referring to FIGS. **2**, **9**, and **10**, a plurality of lock core seats **20** are equidistantly, annularly provided to an inner periphery of the rotating disc **20**. Each lock core seat **20** includes a slotted hole **221** (namely, a longitudinal slot is defined in a wall defining the hole **221**) for receiving a lock core **100**. The hole **221** has a diameter slightly greater than a relatively smaller diameter of the lock core **100** yet smaller than a relatively larger diameter of the lock core **100**. Thus, the lock core **100** can be held in the lock core seat **22**. In order to prevent rotation of the lock core **100** in the lock core seat **22**, a transverse hole **222** (preferably threaded) is defined in the lock core seat **22** for receiving a retainer **223**, an elastic element **224**, and a fixing member **225** with an outer threading for threadedly engaged with the transverse screw hole **222**. The retainer **223** is made of soft material and biased outward by the elastic element **224** to bear against the lock core **100** and thus retain the lock core **100** in place, thereby preventing rotation of the lock core **100** in the lock core seat **22**. It is appreciated that the retainer **223** is partially received in the transverse hole **222** when the former is biased outward. In addition, the lock core seat **22** may include an inner seat **26** secured in place by the fixing member **225**. The inner seat **26** may be easily and quickly replaced by a new one if a change in the diameter of the slotted hole is required.

Referring to FIGS. **1** and **10**, the milling disc **30** is connected to and thus actuated by a cylinder **31** so as to move vertically upon actuation of the cylinder **31** that is secured to the top plate **12** of the frame **10**. The milling disc **30** includes a plurality of downwardly extending rods **32** each having a cutter **33** attached to a distal end thereof (FIG. **5**). The cutters **33** are arranged equidistantly on the same circle to mill the lock core keyway gradually (step by step). Thus, upon intermittent rotation of the rotating disc **20**, the lock core **100** is milled step by step by the cutters **33** one by one and finally forms its keyway.

Referring to FIGS. **2**, **10**, and **11**, an upper sensor **36** and a lower sensor **37** are provided to the fixed wall **40**. When the cutters **33** are disengaged from the lock core seats **22**, the cutters **33** are moved to engage with the upper sensor **36** (if moved upward, FIG. **10**) or the lower sensor **37** (if moved downward, FIG. **11**). A signal is sent to cause rotation of the rotating disc **20**. Namely, rotation of the rotating disc **20** cannot be undergone unless it is confirmed that the cutters **33** are disengaged from the lock core seats **22** by detecting contact between the cutters **33** and either sensor **36**, **37**.

Referring to FIGS. **1**, **2**, and **12**, one of the rods **32** has an ejecting plate **34** for ejecting a milled lock core **100** from the lock core seat **22**. The ejecting plate **34** is plate-like and is capable of ejecting the lock core **100** upward via the slotted hole **221** of the lock core seat **22** when the milling disc **30** is moved upward, thereby causing the lock core **100** to fall into the collecting box **17** via a guide plate **171**.

Referring to FIGS. **2**, **5**, and **13**, in order to check whether the milled keyway of every lock core meets the preset standard, a detector **35** is secured to each rod **32** and located behind the associated cutter **33** along the rotating direction. The detectors **35** and the cutters **33** are equidistantly arranged on the same circle. When the rotating disc **20** is rotated through a tooth pitch, the lock core **100** in the lock core seat **22** aligns with to an associated cutter and an associated detector **35**. Thus, when the milling disc **30** is moved downward, the cutters **33** mill the lock core **100**. When the milling disc **30** is moved upward, the detector **35** checks whether the keyway is milled to meet the required standard. The detector **35** has a plate with a width slightly smaller than the cutter **33**. Thus, when the plate of the detector **35** is in contact with the lock core **100** (i.e., the milled keyway does not meet the required standard), a signal is sent by a sensor **38** to stop the whole milling apparatus for replacing the abnormal cutter **33**.

Referring to FIGS. **2**, **3**, and **5**, in order to provide stable vertical movements for the cutters **33**, the ejecting plate **34**, and the detectors **35**, the annular fixed wall **40** on the frame **10** includes a plurality of tracks **41** for slidingly engaging with fixing seats **330**, **340**, and **350** respectively for the cutters **33**, the ejecting plate **34**, and the detectors **35**. Thus, when the milling disc **30** moved vertically, the cutters **33**, the ejecting plate **34**, and the detectors **35** move rectilinearly along the vertical direction without any deviation.

Referring to FIGS. **2** and **10**, the milling disc **30** is moved downward for milling the keyway when the lock core seat **22**

is in a position aligned with an associated cutter **33** (FIG. **11**). After the milling disc **30** is moved downward to a preset position, the lower sensor **37** sends a signal (the cutter **33** disengages from the lock core **100** and the lock core seat **22**) to actuate the cylinder **13** for rotating the disc **20** clockwise through a tooth pitch (FIG. **3**). The lock core **100** is in a position aligned with a detector **35**. Thus, when the milling disc **30** is moved upward, the keyway just milled is allowed to pass through the detector **35** if the keyway meets the required standard. At this time, the cutter **33** does not contact with the lock core **100** during the upward movement of the milling disc **30**. The lock core **100** is milled by all cutters **33** one by one when the rotating disc **20** is rotated through 360°. The finished lock core **100** is ejected upward by the ejecting plate **34** and thus falls into the collection box **17**. New lock cores **100** are supplied via the lock core supplying means **14** for milling.

According to the above description, it is appreciated that the lock cores are milled quickly and precisely by the circulating type milling apparatus in accordance with the present invention.

Although the invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. A circulating type milling apparatus for milling a lock core keyway, comprising:

a frame including a plurality of posts and a top plate supported by the posts, the frame further comprising a lock core supplying means for guiding a plurality of lock cores to fall one by one, the frame further comprising a collecting box and a guide plate for guiding milled lock cores into the collecting box, the frame further including a ratchet tooth member;

a rotating disc intermittently driven by the ratchet tooth member, the rotating disc including a plurality of equidistantly arranged lock core seats located on the same circle, each said lock core seat holding an associated said lock core therein;

an actuating cylinder secured to the to plate and including an actuating rod;

a milling disc connected to and thus actuatable by the actuating rod in a vertical direction, the milling disc including a plurality of downwardly extending rods each having a cutter secured thereto, the cutters being arranged equidistantly on the same circle for milling each said lock core gradually, each said rod further including a detector provided thereon, wherein one of the rods including an ejecting plate provided thereon and located between a first one of the cutters and the last one of the detectors, each said detector being located behind an associated said cutter on the same rod along a rotating direction of the rotating disc, each said detector including a plate with a width slightly smaller than that of the associated cutter;

a plurality of fixing seats mounted to the rods for securely receiving the cutters, the ejecting plate, and the detectors, respectively; and

a fixed wall including a plurality of tracks for providing sliding engagement with the fixing seats for the cutters, the ejecting plates, and the detectors, the fixed wall further including a lower sensor and an upper sensor mounted thereon;

whereby when the milling disc is moved downward, the cutters mill a keyway in each said lock core, when the cutters are moved downward to a position in contact with the lower sensor, the lower sensor sends a signal to cause the rotating disc to rotate through a tooth pitch, and the milling disc is then moved upward, and each said detector checks whether the keyway just milled meets a required standard, and wherein a completely milled lock core is ejected by the ejecting plate.

2. The circulating type milling apparatus for milling a lock core keyway as claimed in claim **1**, further comprising a second cylinder with a second actuating rod to which the ratchet tooth member is connected, and a resilient plate for biasing the ratchet tooth member to engage with the teeth of the rotating wheel, thereby driving the rotating wheel in one direction when the second actuating rod is actuated.

3. The circulating type milling apparatus for milling a lock core keyway as claimed in claim **1**, wherein the lock core supplying means including a guide tube to allow the lock cores in the guide tube to fall one by one, each said lock core seat including a slotted hole, and further comprising a support plate for supporting the lock core from the guide tube, the support plate including a hole communicated with an associated said lock core seat, a second cylinder with a second actuating rod, a stop plate being connected to the second actuating rod to move therewith, the stop plate being movable between a first position below the guide tube to prevent falling of the lock cores and a second position away from the guide tube to allow falling of one of the lock cores onto the support plate, the lock core on the support plate being pushed by the second actuating rod and falling into the slotted hole of the associated lock core seat via the hole of the support plate.

4. The circulating type milling apparatus for milling a lock core keyway as claimed in claim **3**, further comprising a third cylinder above the hole of the support plate for pushing the lock core on the support plate into the slotted hole of the associated lock core seat.

5. The circulating type milling apparatus for milling a lock core keyway as claimed in claim **3**, wherein each said lock core seat includes a transverse hole communicated with the slotted hole thereof, a retainer and an elastic element being mounted in the transverse hole and sealed by a fixing member that is also mounted in the transverse hole, the elastic element biasing the retainer into the slotted hole of the lock core seat for retaining the lock core in the lock core seat in place.

6. The circulating type milling apparatus for milling a lock core keyway as claimed in claim **1**, wherein each said lock core seat includes a replaceable inner seat that is retained by a fixing member, wherein the inner seat is replaced when a change in a diameter of the slotted hole of the lock core is required.

7. The circulating type milling apparatus for milling a lock core keyway as claimed in claim **5**, wherein the retainer is made of soft material.

8. The circulating type milling apparatus for milling a lock core keyway as claimed in claim **1**, wherein the rotating disc includes a plurality of positioning members each including a steel ball and an elastic element for biasing the steel ball, and wherein the frame includes a plurality of arcuate depressions each for releasably retaining an associated said steel ball biased by an associated steel ball, thereby retaining the rotating disc in place after each rotational movement thereof.

* * * * *